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(54) ELASTICALLY AVERAGED ALIGNMENT SYSTEMS AND METHODS

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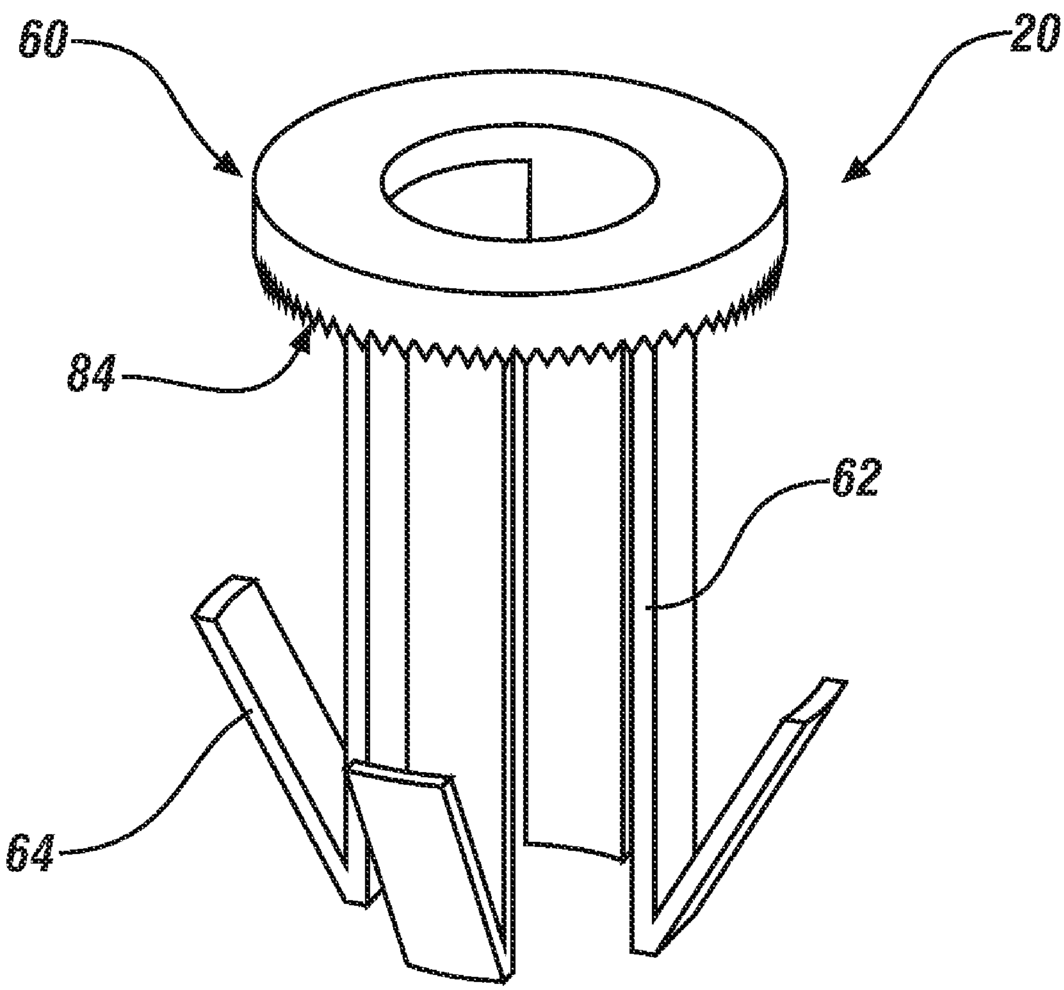
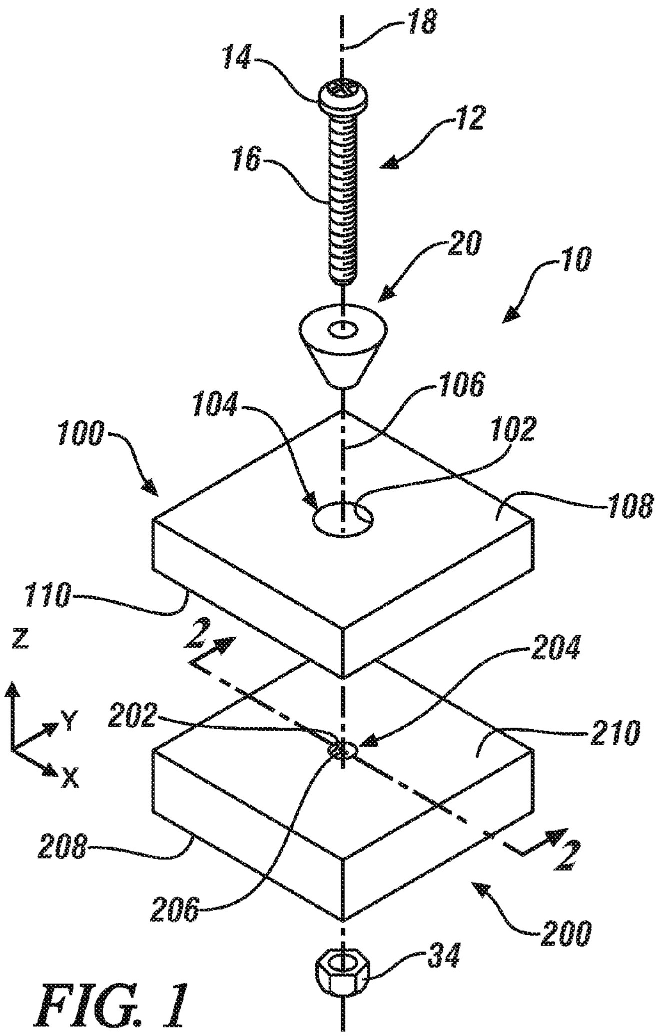
(57) ABSTRACT

In one aspect an elastically averaged alignment system is provided. The alignment system includes a first component comprising an inner wall defining an alignment aperture, a second component including a receiving aperture, and a fastener configured for insertion into the alignment aperture and the receiving aperture to couple the first and second components. The system further includes an elastically deformable collar inserted onto the fastener. The collar is configured to elastically deform against the inner wall to an elastically averaged final configuration upon insertion into the alignment aperture, thereby coupling the first and second components to facilitate aligning the first component and the second component in a desired orientation.

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14
12
16
20
10
104
106
102
100
108
110
Z
2
204
Y
202
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X
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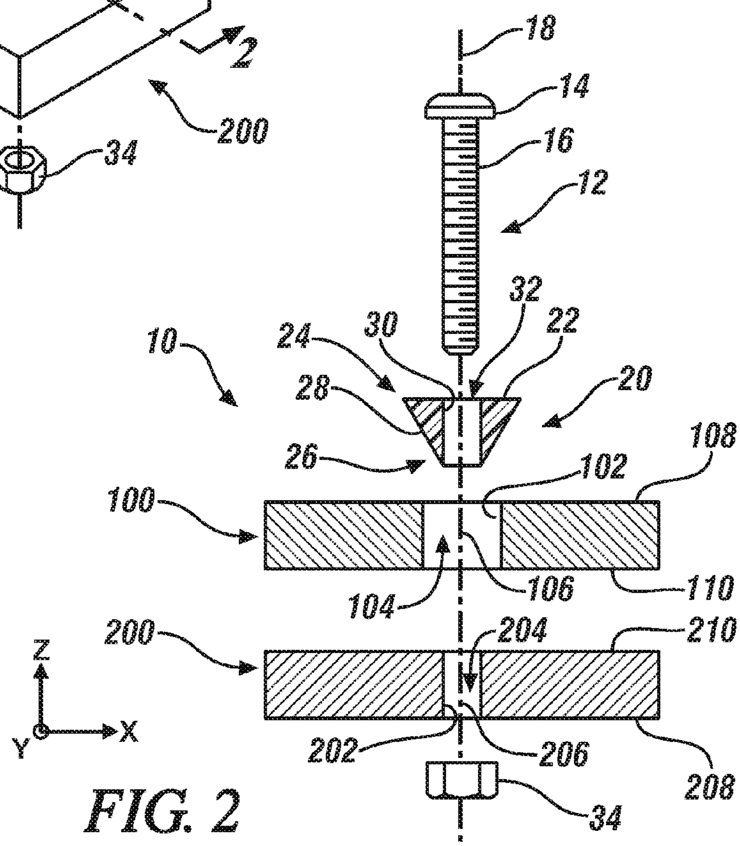
2
206
200
34

FIG. 1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24
30
20
28
26
108
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100
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200
204
210
Z
X
Y
202
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208
34

FIG. 2

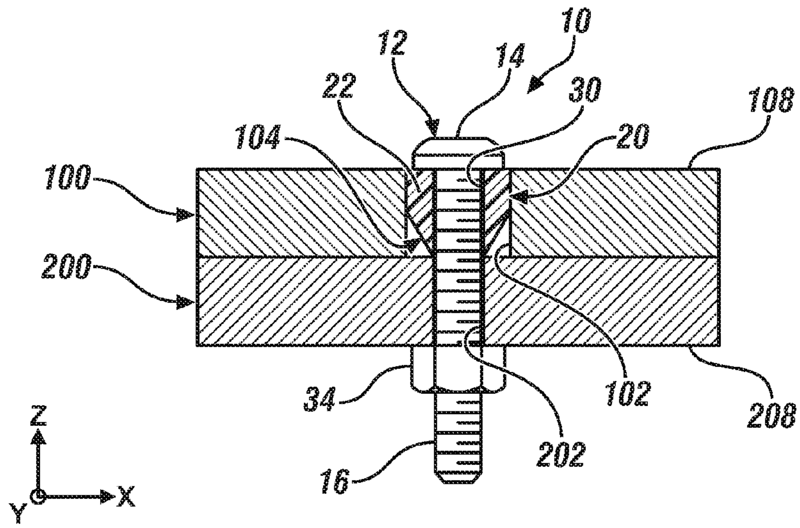

FIG. 3

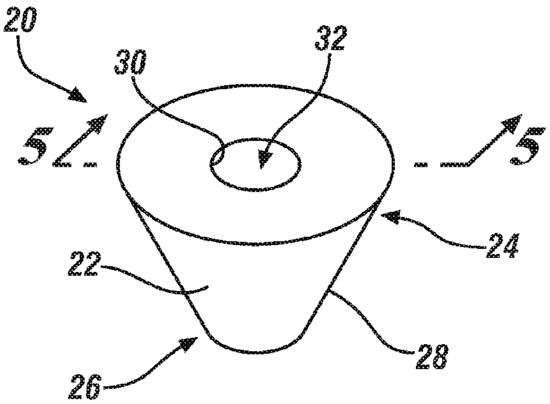

FIG. 4

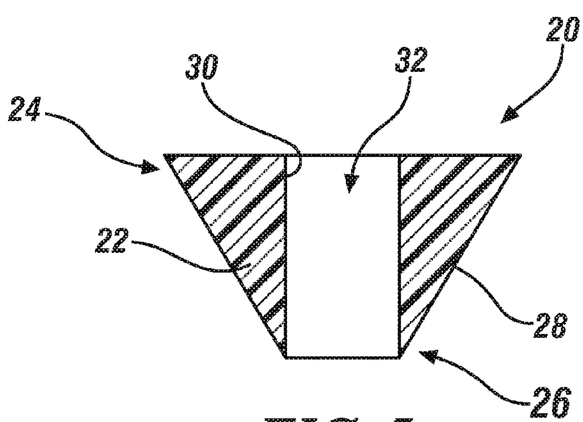

FIG. 5

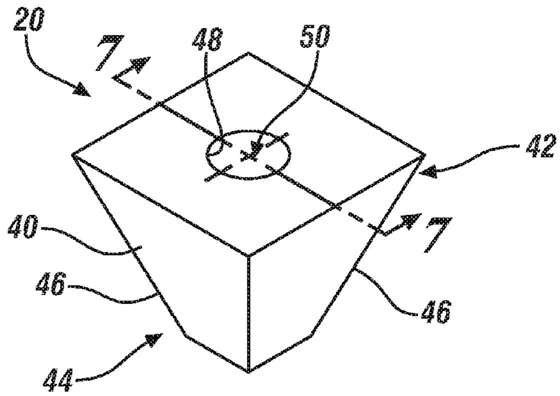

FIG. 6

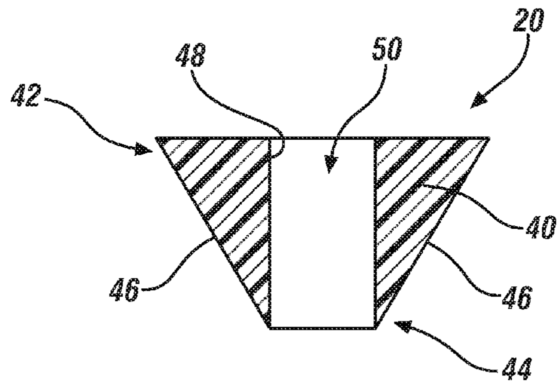

FIG. 7

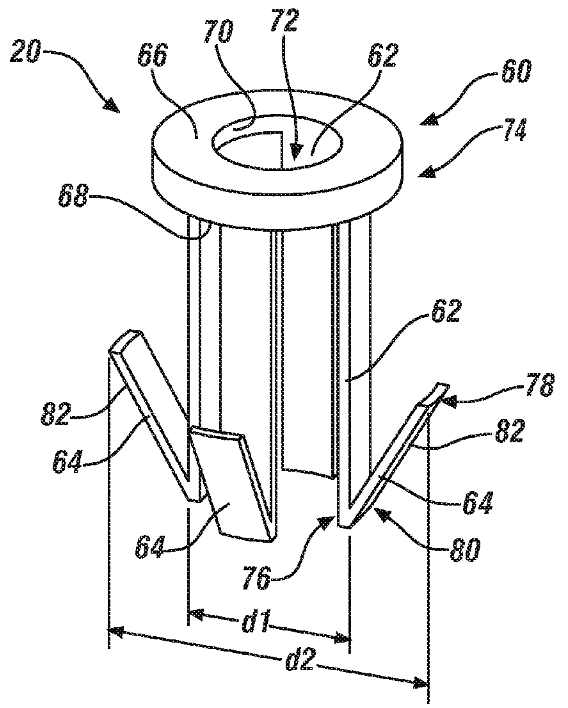

FIG. 8

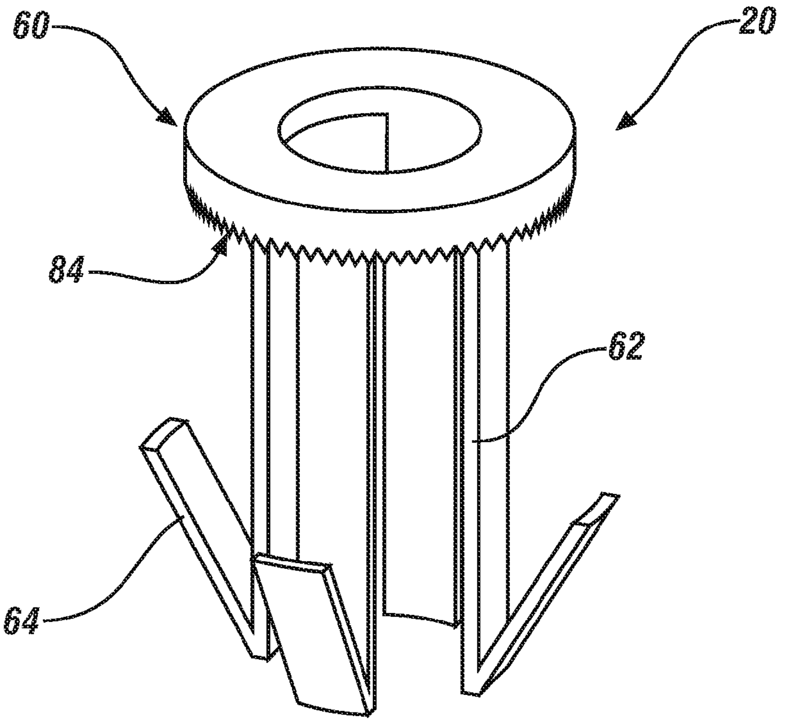

FIG. 9

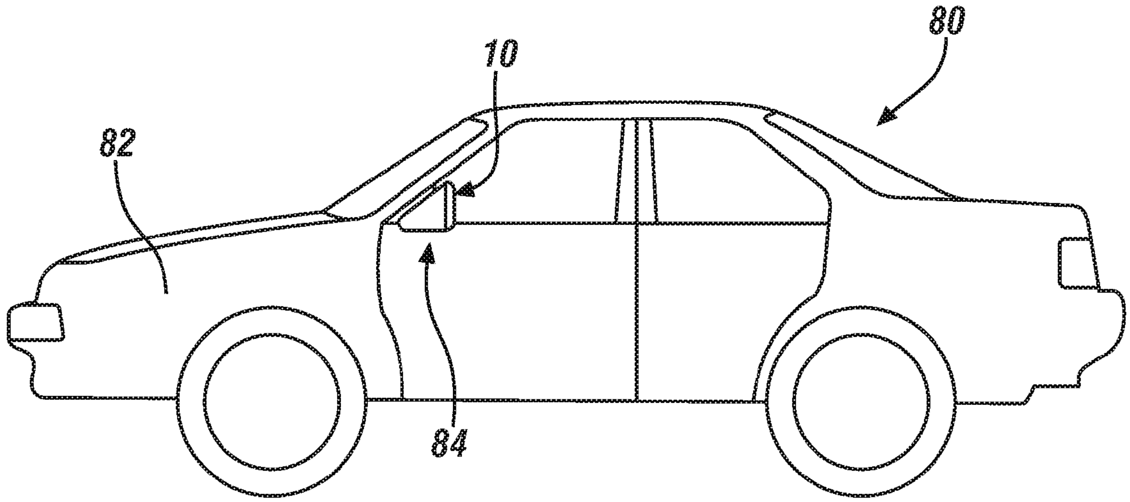

FIG. 10

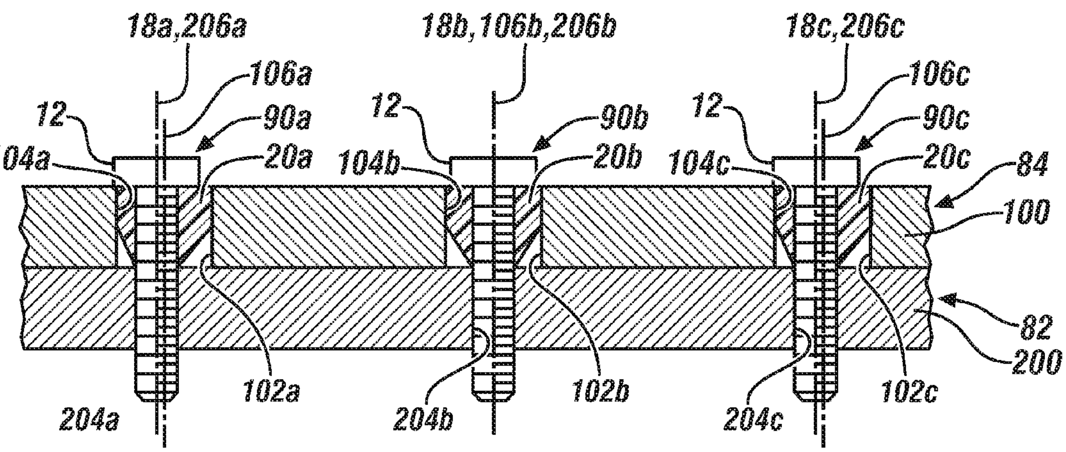
18a,206a
106a
12
90a
104a
20a
18b,106b,206b
12
90b
104b
20b
18c,206c
106c
12
90c
104c
20c
84
100
82
200
204a
102a
204b
102b
204c
102c

FIG. 11

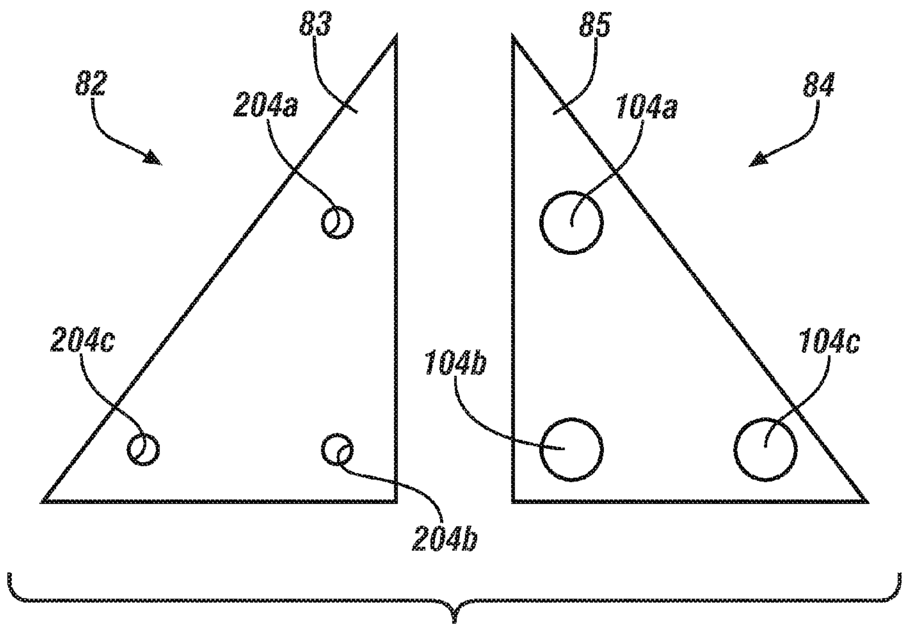
83
85
82
204a
104a
84
204c
104b
104c
204b

FIG. 12

ELASTICALLY AVERAGED ALIGNMENT SYSTEMS AND METHODS

FIELD OF THE INVENTION

[0001] The subject invention relates to matable components and, more specifically, to elastically averaged matable components for alignment.

BACKGROUND

[0002] Some known components, in particular some vehicular components, which are to be mated together in a manufacturing process may be mutually located with respect to each other by alignment features that are oversized holes and undersized threaded bolts. Such alignment features are typically sized to provide spacing to freely move the components relative to one another to align them without creating an interference therebetween that would hinder the manufacturing process. One such example includes the use of threaded bolts, which are received into corresponding female alignment features, typically apertures in the form of slots or holes. The components are formed with a predetermined clearance between the threaded bolts and their respective female alignment features to match anticipated size and positional variation tolerances of the alignment features that result from manufacturing (or fabrication) variances.

[0003] As a result, significant positional variation can occur between two mated components having the aforementioned alignment features, which may contribute to the presence of undesirably large variation in their alignment, particularly with regard to gaps and/or spacing therebetween. In the case where misaligned components are also part of another assembly, such misalignment may also affect the function and/or aesthetic appearance of the entire assembly (i.e., manufacturing stack-up). Regardless of whether such misalignment is limited to two components or an entire assembly, it can negatively affect function and result in a perception of poor quality. Moreover, clearance between misaligned components may lead to relative motion therebetween, which may cause undesirable noise such as squeaking and rattling, and further result in the perception of poor quality.

SUMMARY OF THE INVENTION

[0004] In one aspect an elastically averaged alignment system is provided. The alignment system includes a first component comprising an inner wall defining an alignment aperture, a second component including a receiving aperture, and a fastener configured for insertion into the alignment aperture and the receiving aperture to couple the first and second components. The system further includes an elastically deformable collar inserted onto the fastener. The collar is configured to elastically deform against the inner wall to an elastically averaged final configuration upon insertion into the alignment aperture, thereby coupling the first and second components to facilitate aligning the first component and the second component in a desired orientation.

[0005] In another aspect a vehicle is provided. The vehicle includes a body and an elastically averaged alignment system integrally arranged within the body. The elastically averaged alignment system includes a first component including an inner wall defining an alignment aperture, a second component including a receiving aperture, and a fastener configured for insertion into the alignment aperture and the receiving aperture to couple the first and second component. The alignment system further includes an elastically deformable collar inserted onto the fastener. The collar is configured to elastically deform against the inner wall to an elastically averaged final configuration upon insertion into the alignment aperture, thereby coupling the first and second components to facilitate aligning the first component and the second component in a desired orientation

[0006] The above features and advantages and other features and advantages of the invention are readily apparent from the following detailed description of the invention when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Other features, advantages and details appear, by way of example only, in the following detailed description of embodiments, the detailed description referring to the drawings in which:

[0008] FIG. **1** is a perspective view of an exemplary disassembled elastically averaged alignment system;

[0009] FIG. **2** is a cross-sectional view of the elastically averaged alignment system shown in FIG. **1** and taken along line **2-2** of FIG. **1**;

[0010] FIG. **3** is a cross-sectional view of the elastically averaged alignment system shown in FIGS. **1** and **2** following assembly;

[0011] FIG. **4** is a perspective view of an exemplary elastically deformable collar used in the system shown in FIGS. **1-3**;

[0012] FIG. **5** is a cross-sectional view of the elastically deformable collar shown in FIG. **4** and taken along line **5-5** of FIG. **4**;

[0013] FIG. **6** is a perspective view of another exemplary elastically deformable collar that may be used in the system shown in FIG. **1**;

[0014] FIG. **7** is a cross-sectional view of the elastically deformable collar shown in FIG. **6** and taken along line **7-7** of FIG. **6**;

[0015] FIG. **8** is a perspective view of yet another exemplary elastically deformable collar that may be used in the system shown in FIG. **1**;

[0016] FIG. **9** is a perspective view of the elastically deformable collar shown in FIG. **8** and including a plurality of locking teeth;

[0017] FIG. **10** is a side view of a vehicle that may use any of the embodiments shown in FIGS. **1-9**;

[0018] FIG. **11** is a cross-sectional view of another exemplary elastically averaged alignment system that may be used with the vehicle shown in FIG. **10**; and

[0019] FIG. **12** is a side view of an exemplary side mirror and vehicle body shown in FIG. **11**, before assembly.

DETAILED DESCRIPTION

[0020] The following description is merely exemplary in nature and is not intended to limit the present disclosure, its application or uses. For example, the embodiments shown are applicable to vehicle body panels, but the alignment system disclosed herein may be used with any suitable components to provide elastic averaging for precision location and alignment of all manner of mating components and component applications, including many industrial, consumer product (e.g., consumer electronics, various appliances and the like), transportation, energy and aerospace applications, and particularly including many other types of vehicular components and applications, such as various interior, exterior and under hood vehicular components and applications. It should be understood that throughout the drawings, corresponding reference numerals indicate like or corresponding parts and features.

[0021] As used herein, the term "elastically deformable" refers to components, or portions of components, including component features, comprising materials having a generally elastic deformation characteristic, wherein the material is configured to undergo a resiliently reversible change in its shape, size, or both, in response to the application of a force. The force causing the resiliently reversible or elastic deformation of the material may include a tensile, compressive, shear, bending or torsional force, or various combinations of these forces. The elastically deformable materials may exhibit linear elastic deformation, for example that described according to Hooke's law, or non-linear elastic deformation.

[0022] Elastic averaging provides elastic deformation of the interface(s) between mated components, wherein the average deformation provides a precise alignment, the manufacturing positional variance being minimized to X_{min}, defined by $X_{min}=x/\sqrt{N}$, wherein X is the manufacturing positional variance of the locating features of the mated components and N is the number of features inserted. To obtain elastic averaging, an elastically deformable component is configured to have at least one feature and its contact surface (s) that is over-constrained and provides an interference fit with a mating feature of another component and its contact surface(s). The over-constrained condition and interference fit resiliently reversibly (elastically) deforms at least one of the at least one feature or the mating feature, or both features. The resiliently reversible nature of these features of the components allows repeatable insertion and withdrawal of the components that facilitates their assembly and disassembly. Positional variance of the components may result in varying forces being applied over regions of the contact surfaces that are over-constrained and engaged during insertion of the component in an interference condition. It is to be appreciated that a single inserted component may be elastically averaged with respect to a length of the perimeter of the component. The principles of elastic averaging are described in detail in commonly owned, co-pending U.S. patent application Ser. No. 13/187,675, the disclosure of which is incorporated by reference herein in its entirety. The embodiments disclosed above provide the ability to convert an existing component that is not compatible with the above-described elastic averaging principles, or that would be further aided with the inclusion of a four-way elastic averaging system as herein disclosed, to an assembly that does facilitate elastic averaging and the benefits associated therewith.

[0023] Any suitable elastically deformable material may be used for the mating components and alignment features disclosed herein and discussed further below, particularly those materials that are elastically deformable when formed into the features described herein. This includes various metals, polymers, ceramics, inorganic materials or glasses, or composites of any of the aforementioned materials, or any other combinations thereof suitable for a purpose disclosed herein. Many composite materials are envisioned, including various filled polymers, including glass, ceramic, metal and inorganic material filled polymers, particularly glass, metal, ceramic, inorganic or carbon fiber filled polymers. Any suitable filler morphology may be employed, including all shapes and sizes of particulates or fibers. More particularly any suitable type of fiber may be used, including continuous and discontinuous fibers, woven and unwoven cloths, felts or tows, or a combination thereof. Any suitable metal may be used, including various grades and alloys of steel, cast iron, aluminum, magnesium or titanium, or composites thereof, or any other combinations thereof. Polymers may include both thermoplastic polymers or thermoset polymers, or composites thereof, or any other combinations thereof, including a wide variety of co-polymers and polymer blends. In one embodiment, a preferred plastic material is one having elastic properties so as to deform elastically without fracture, as for example, a material comprising an acrylonitrile butadiene styrene (ABS) polymer, and more particularly a polycarbonate ABS polymer blend (PC/ABS). The material may be in any form and formed or manufactured by any suitable process, including stamped or formed metal, composite or other sheets, forgings, extruded parts, pressed parts, castings, or molded parts and the like, to include the deformable features described herein. The elastically deformable alignment features and associated component may be formed in any suitable manner. For example, the elastically deformable alignment features and the associated component may be integrally formed, or they may be formed entirely separately and subsequently attached together. When integrally formed, they may be formed as a single part from a plastic injection molding machine, for example. When formed separately, they may be formed from different materials to provide a predetermined elastic response characteristic, for example. The material, or materials, may be selected to provide a predetermined elastic response characteristic of any or all of the elastically deformable alignment features, the associated component, or the mating component. The predetermined elastic response characteristic may include, for example, a predetermined elastic modulus.

[0024] As used herein, the term vehicle is not limited to just an automobile, truck, van or sport utility vehicle, but includes any self-propelled or towed conveyance suitable for transporting a burden.

[0025] Described herein are alignment systems and methods for elastically averaged mating assemblies. The alignment systems include elastically deformable collars that are fitted to a fastener that is inserted into two or more components. The collar facilitates elastic averaging between components during fastener insertion, thereby resulting in proper alignment between the components.

[0026] FIGS. **1-3** illustrate an exemplary elastically averaged alignment system **10** that generally includes a first component **100** to be mated to a second component **200** utilizing a fastener **12** and an elastically deformable collar **20**. First component **100** includes an inner wall **102** defining an alignment aperture **104** having a centerline **106**, and second component **200** includes an inner wall **202** defining a receiving aperture **204** having a centerline **206**. Alignment aperture **104** is generally aligned with receiving aperture **204** for insertion of fastener **12** therethrough. Although a single pair of corresponding alignment aperture **104** and receiving aperture **204** is illustrated, components **100** and **200** may have any number and combination of corresponding apertures **104** and **204**.

[0027] In the exemplary embodiment, first component **100** includes an outer face **108** and an inner face **110** and is fabricated from a rigid material such as plastic. However, first component **100** may be fabricated from any suitable material that enables system **10** to function as described herein. In addition, inner face **110** may include one or more tabs or flanges (not shown) at least partially circumscribing alignment aperture **104** and extending outwardly from inner face **110** that are formed during a punching or a similar process used to form alignment aperture **104**. In the exemplary embodiment, alignment aperture **104** has a generally circular cross-section. Alternatively, alignment aperture **104** may have any shape that enables system **10** to function as described herein. For example, alignment aperture **204** may be an elongated slot (e.g., similar to the shape of elastic tube alignment system described in co-pending U.S. patent application Ser. No. 13/187,675 and particularly illustrated in FIG. **13** of the same). Second component **200** includes an outer face **208** and an inner face **210** and is similarly fabricated from a rigid material, for example, sheet metal. However second component **200** may be fabricated from any suitable material that enables system **10** to function as described herein.

[0028] While not being limited to any particular structure, first component **100** may be a decorative trim component of a vehicle with the customer-visible side being outer face **108**, and second component **200** may be a supporting substructure that is part of, or is attached to, the vehicle and on which first component **100** is fixedly mounted in precise alignment.

[0029] In the exemplary embodiment, fastener **12** is a threaded bolt having a head portion **14**, a threaded shank portion **16**, and a centerline **18**. Alternatively, fastener **12** may be any suitable fastener that enables system **10** to function as described herein. It is important to note that the diameter of shank portion **16** is smaller than the diameter or cross-section of alignment aperture **104**. In known components, the threaded fastener is undersized and a component aperture is oversized to enable one component to move relative to the other to manually orient the components. Elastically deformable collar **20** may facilitate substantial alignment of centerlines **18**, **106**, and **206**, as is described herein in more detail. However, centerlines **18**, **106**, and/or **206** may be slightly offset due to the elastic averaging over the entire system **10**.

[0030] In the exemplary embodiment, and with further reference to FIGS. **4** and **5**, elastically deformable collar **20** includes a body **22** having a first end **24**, a second end **26**, an outer wall **28**, and an inner wall **30** defining an aperture **32**. Outer wall **28** is generally tapered such that a cross-section of collar **20** proximate first end **24** is larger than a cross-section of collar **20** proximate second end **26**. In the exemplary embodiment, body **22** is substantially conical. Alternatively, body **22** may have any tapered shape that enables elastically deformable collar **20** to function as described herein. For example, body **22** may be substantially pyramidal as illustrated in FIGS. **6** and **7**, and as described herein in more detail.

[0031] Elastically deformable collar aperture **32** is sized to receive threaded shank **16** through first end **24** such that fastener head portion **14** seats against first end **24**. Alternatively, collar **20** may be formed integrally with fastener **12**. Collar **20** and fastener **12** are then insertable into alignment aperture **104**. Elastically deformable collar **20** is configured and disposed to interferingly, deformably, and matingly engage alignment aperture **104**, as discussed herein in more detail, to precisely align first component **100** with second component **200** in two or four directions, such as the +/− x-direction and the +/− y-direction of an orthogonal coordinate system, for example, which is herein referred to as two-way and four-way alignment.

[0032] To provide an arrangement where elastically deformable collar **20** is configured and disposed to interferingly, deformably and matingly engage alignment aperture **104**, the diameter or cross-section of alignment aperture **104** is less than the diameter or cross-section of collar body first end **24**, which necessarily creates a purposeful interference fit between elastically deformable collar **20** and alignment aperture **104**. As such, when inserted into alignment aperture **104**, portions of the elastically deformable collar **20** elastically deform to an elastically averaged final configuration that substantially aligns fastener centerline **18**, alignment aperture centerline **106**, and receiving aperture centerline **206** in four planar orthogonal directions (the +/− x-direction and the +/− y-direction). Where alignment aperture **104** is an elongated slot (not shown), centerlines **18**, **106** and **206** are aligned in two planar orthogonal directions (the +/− x-direction or the +/− y-direction). In the exemplary embodiment, a threaded nut **34** is threaded to threaded shank **16** after insertion of fastener **12** into alignment aperture **104** and receiving aperture **204**. Threading of nut **34** onto shank **16** facilitates drawing collar **20** into alignment aperture **104** where it is elastically deformed and aligns and secures components **100** and **200** in a desired orientation. Alternatively, or in addition, receiving aperture **204** may be threaded and threaded shank **16** threads directly therein to facilitate drawing collar **20** into alignment aperture **104**.

[0033] While FIGS. **1**-**3** depict a single elastically deformable collar **20** in a corresponding circular alignment aperture **104** to provide four-way alignment of the first component **100** relative to the second component **200**, it will be appreciated that the scope of the invention is not so limited and encompasses other quantities and types of elastically deformable alignment elements used in conjunction with elastically deformable collar **20** and corresponding alignment aperture **104**.

[0034] FIGS. **6** and **7** illustrate an alternative embodiment of elastically deformable collar **20** that is similar to the collar shown in FIGS. **1**-**5**, but includes a generally pyramidal body **40**. In the exemplary embodiment, pyramidal body **40** includes a first end **42**, a second end **44**, outer walls **46**, and an inner wall **48** defining an aperture **50**. Outer walls **46** are generally tapered such that a cross-section of collar **20** proximate first end **42** is larger than a cross-section of collar **20** proximate second end **44**. While pyramidal body **40** is illustrated with four outer walls **46**, body **40** may have any number of outer walls **46**. For example, pyramidal body may have three or five outer walls **46**. Elastically deformable collar aperture **50** is sized to receive threaded shank **16** through first end **42** such that fastener head portion **14** is seated against first end **42**. Collar **20** is configured and disposed to interferingly, deformably, and matingly engage alignment aperture **104** to precisely align first component **100** with second component **200** in two or four directions, such as the +/− x-direction and the +/− y-direction of an orthogonal coordinate system.

[0035] FIG. **8** illustrates another alternative embodiment of elastically deformable collar **20**. In the exemplary embodiment, collar **20** generally includes a collar portion **60**, a plurality of arms **62**, and a plurality of biasing arms **64**. Collar portion **60** is generally annular and includes a first surface **66**, an opposite second surface **68**, and an inner wall **70** defining an aperture **72**. Alternatively, collar portion **60** may have any suitable shape such as, for example, a generally square shape. The diameter or cross-section of collar portion **60** is larger than the diameter or cross-section of alignment aperture **104**, and at least a portion of second surface **68** may seat against outer surface **108** after insertion of collar **20**. Arms **62** extend from second surface **68** and each includes a proximal end **74**

coupled to collar second surface **68** and a distal end **76**. Each biasing arm **64** extends angularly from one arm **62** and includes a first end **78** and a second end **80** coupled to arm proximal end **74**. In the exemplary embodiment, collar **20** includes four sets of arms **62** and biasing arms **64**. However, collar **20** may have any number of arms **62** and biasing arms **64** that enables system **10** to function as described herein.

[0036] Biasing arms **64** define a generally tapered surface **82** having a first diameter d1 proximate second end **80** that is smaller than a second diameter d2 proximate first end **78**. Aperture **72** is sized to receive threaded shank **16** such that fastener head portion **14** is seated against first surface **66**. As collar **20** is inserted into alignment aperture **104** (as shown in FIGS. **1-3**), tapered surface **82** contacts inner wall **104** due to the increasing diameter from d1 to d2, and arms **62** and/or biasing arms **64** elastically deform inward toward centerline **106**. Accordingly, arms **62** and/or biasing arms **64** are configured and disposed to interferingly, deformably, and matingly engage inner wall **202** alignment aperture **104** to precisely align first component **100** with second component **200** in two or four directions, such as the +/− x-direction and the +/− y-direction of an orthogonal coordinate system.

[0037] Additionally, as shown in FIG. **9**, collar portion **60** may include a plurality of teeth **84** to facilitate engagement (e.g., locking) between fastener **12** and first component outer surface **108** to prevent torsion of fastener **12** once fastener **12** is tightened to secure components **100** and **200**. Alternatively, collar portion **60** may have any suitable locking feature that enables collar portion **60** to resist torsion or loosening of fastener **12**. For example, collar portion **60** may include any type of lock washer structure.

[0038] In view of the foregoing, and with reference to FIG. **10**, it will be appreciated that an embodiment of the invention also includes a vehicle **80** having a body **82** with an elastically averaged alignment system **10** as herein disclosed integrally arranged with the body **82**. In the embodiment of FIG. **10**, the elastically averaged alignment system **10** is depicted forming at least a portion of a side mirror **84** of the vehicle **80**. However, it is contemplated that an elastically averaged alignment system **10** as herein disclosed may be utilized with other features of the vehicle **80**, such as chassis components, interior components, and powertrain components.

[0039] FIG. **11** illustrates an exemplary illustration of elastically averaged alignment system **10** for the coupling between a portion of side mirror **84** and vehicle body **82** shown in FIG. **10**. As shown, a plurality of fastener and collar configurations **90***a*, **90***b*, and **90***c* are inserted into a plurality of corresponding alignment apertures **104***a*, **104***b*, **104***c* and receiving apertures **204***a*, **204***b*, **204***c*. Collars **20***a*, **20***b*, and **20***c* facilitate elastic averaging over the total of fasteners **12** to facilitate aligning centerlines **18**, **106**, and **206** leading to an improved coupling between first component **100** and second component **200**. As shown with collar pairing **90***b*, collar **20***b* elastically deforms within alignment aperture **104***b* to align centerlines **18***b*, **106***b*, and **206***b*. Due, for example, to the manufacturing tolerance and variance of oversized alignment apertures **104***a-c*, alignment aperture centerlines **106***a* and **106***c* are actually formed farther from centerline **106***b* than designed. Collars **20***a* and **20***c* elastically deform within respective alignment apertures **104***a* and **104***c* to facilitate bringing centerlines **106***a* and **106***c* more in-line with respective centerlines **18***a*, **206***a* and **18***c*, **206***c*. As shown, the left portion of collars **20***a*, **20***c* deforms more than the right portion of collars **20***a*, **20***c* to substantially align the centerlines such that centerlines **104***a*, **104***c* are only slightly off-set from respective centerlines **18***a*, **206***a* and **18***c*, **206***c*. Accordingly, collar and fastener configurations **90***a*, **90***b*, **90***c* elastically average the alignment features of first and second components **100**, **200** to couple them in a desired orientation.

[0040] FIG. **12** illustrates an exemplary illustration of the orientation of alignment apertures **104***a*, **104***b*, and **104***c* of side mirror **84** and receiving apertures **204***a*, **204***b*, and **204***c* of vehicle body **82**. As shown, a portion of vehicle body **82** such as a door sheet metal **83** is substantially triangular with a receiving aperture **204** located proximate each corner of the triangular shape. Similarly, a portion of side mirror **84** such as a base **85** is substantially triangular with alignment apertures **104** located proximate each corner of the triangular shape. As previously described, collars **90** are inserted into alignment apertures **104** and receiving apertures **204** to couple side mirror **84** to vehicle body **82**.

[0041] Systems and methods for elastically averaged mating assemblies are described herein. The systems generally include a first component with an alignment aperture, a second component with a receiving aperture corresponding to the alignment aperture, a fastener, and an elastically deformable collar. The fastener is inserted into the collar and the two are inserted into the alignment aperture and receiving aperture. The collar elastically deforms against the walls of the alignment aperture to facilitate centering the fastener relative to the center of the alignment aperture to precisely mate the components in a desired orientation. Accordingly, the mating of the first and second components is elastically averaged over a corresponding pair or pairs of deformable collars and alignment apertures.

[0042] While the invention has been described with reference to exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiments disclosed, but that the invention will include all embodiments falling within the scope of the application.

What is claimed is:

1. An elastically averaged alignment system comprising:

a first component comprising an inner wall defining an alignment aperture;

a second component comprising a receiving aperture;

a fastener configured for insertion into said alignment aperture and said receiving aperture to couple said first and second components; and

an elastically deformable collar inserted onto said fastener, said collar configured to elastically deform against said inner wall to an elastically averaged final configuration upon insertion into said alignment aperture, thereby coupling said first and second components to facilitate aligning said first component and said second component in a desired orientation.

2. The system of claim **1**, wherein said elastically deformable collar is tapered.

3. The system of claim **1**, wherein said elastically deformable collar is substantially conical or substantially pyramidal.

4. The system of claim **1**, wherein said fastener comprises a head portion and a shank portion, said shank portion having a cross-section smaller than a cross-section of said alignment aperture.

5. The system of claim **4**, wherein said fastener further comprises a first centerline and said alignment aperture comprises a second centerline, wherein when said fastener couples said first and second components, said elastically deformable collar elastically deforms against said alignment aperture inner wall to substantially align said first centerline and said second centerline.

6. The system of claim **1**, wherein said receiving aperture is threaded, said fastener configured with complementary threads to couple said first and second components by threading into said threaded receiving aperture.

7. The system of claim **1**, wherein said collar comprises a collar portion, a plurality of arms extending from said collar portion, and a biasing arm extending from each of said arms, wherein said biasing arms are configured to elastically deform against said alignment aperture inner wall when said fastener couples said first and second components.

8. The system of claim **7**, wherein at least a portion of said collar portion includes a lock washer structure to facilitate engagement between said fastener and said first component.

9. A vehicle comprising:

a body; and

an elastically averaged alignment system integrally arranged within said body, said elastically averaged alignment system comprising:

a first component comprising an inner wall defining an alignment aperture;

a second component comprising a receiving aperture;

a fastener configured for insertion into said alignment aperture and said receiving aperture to couple said first and second components; and

an elastically deformable collar inserted onto said fastener, said collar configured to elastically deform against said inner wall to an elastically averaged final configuration upon insertion into said alignment aperture, thereby coupling said first and second components to facilitate aligning said first component and said second component in a desired orientation.

10. The vehicle of claim **9**, wherein said elastically deformable collar is substantially conical or substantially pyramidal.

11. The vehicle of claim **9**, wherein said fastener comprises a head portion and a shank portion, said shank portion having a cross-section smaller than a cross-section of said alignment aperture.

12. The vehicle of claim **11**, wherein said fastener further comprises a first centerline and said alignment aperture comprises a second centerline, wherein when said fastener couples said first and second components, said elastically deformable collar elastically deforms against said alignment aperture inner wall to substantially align said first centerline and said second centerline.

13. The vehicle of claim **9**, wherein said collar comprises a collar portion, a plurality of arms extending from said collar portion, and a biasing arm extending from each of said arms, wherein said biasing arms are configured to elastically deform when said fastener couples said first and second components.

14. The vehicle of claim **9**, wherein said first component is a side mirror and said body comprises said second component.

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